KI 2600 Series
Hand Held Fiber Meter

KI 2400/KI 2800 Series
Hand Held Fiber Source

KI 2300/KI 2700 Series
Hand Held Loss Test Meter

OPERATION AND MAINTENANCE GUIDE

KINGFISHER INTERNATIONAL

DECLARATION OF CONFORMITY

IN ACCORDANCE WITH ISO/IEC 17050:2004

Manufacturer's Name: Kingfisher International Pty. Ltd.

Manufacturer's Address: 30 Rocco Drive, Scoresby, Victoria 3179, Australia

hereby declares, that the products listed below

Product Name: Optical Power Meter, Optical Light Source, Optical Loss Test Set
Model Number: KI2000Series
Product Options: *This declaration covers all options of the above product(s)*

complies with the essential requirements of the applicable European Directives:

- Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC, amended by 93/68/EEC, and carries the CE marking accordingly
- Directive 2002/95/EC on restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
- Directive 2002/96/EC on waste electrical and electronic equipment (WEEE)

and conform to the following standards and specifications:

MIL-PRF-28800F: 1996 Performance specification-Test equipment for use with electrical and electronic equipment, general specification

IEC 60529: 2001/ EN 60529:1993+A1:2003 Degrees of protection provided by enclosures

Power Meter conforms to:

IEC 61315:2005 Calibration of fibre-optic power meters

EMC	**Limit**
IEC 61326:2002 / EN 61326-1:1997+A1:1998+A2:2001+A3:2003	
IEC CISPR 11: 2004/ EN 55011:1998+A1:1999	Limits applicable to Group 1 Class B equipment
IEC CISPR 16-1:1999	Limits applicable to Class B equipment
IEC CISPR 16-2:1999	Limits applicable to Class B equipment
IEC 61000-3-2: 2005/EN 61000-3-2:2006	
IEN 61000-3-3:2002/EN 61000-3-3:1995	
IEC 61000-4-2:2001 / EN 61000-4-2:1995+A1:1998+A2:2001	4kV CD, 8kV AD
IEC 61000-4-3:2002/ EN 61000-4-3:2002	3V/m, 80-1000MHz
IEC 61000-4-4:2004/EN 61000-4-4:2004	1kV signal lines, 2kV power lines
IEC 61000-4-5:2005/EN 61000-4-5:2006	1kV line-line, 2kV line-ground
IEC 61000-4-6:2004/EN 61000-4-6:1996+A1:2001	3V, 0.15-80 MHz
IEC 61000-4-11:2004/EN 61000-4-11:2004	0.5 cycle/100%/each polarity
ICES-001: 2006 (Canada)	
CFR 47 FCC Part 15, Subpart B (Exempted devices) (USA)	

Safety

Light Source conforms to:

IEC 60825-1:2011 Safety of laser products - Equipment classification, requirements and user's guide
IEC 60825-2:2011 Safety of laser products - Safety of optical fibre communication systems (OFCS)
CFR 21 part 1040.10 (USA) Performance standards for light- emitting products-Laser products

Supplemental Information:

The product was tested in a typical configuration with Kingfisher International test systems.

10 September 2014
Date

Bruce Robertson
Name

Technical Director
Title

Revision: B

Issue Date: 10 September 2014

OPERATION MANUAL

KI2600 Series Hand Held Fiber Meter

KI2400/2800 Series Hand Held Fiber Source

KI2300/2700 Series Hand Held Loss Test Meter

Congratulations on your purchase of this equipment, engineered to provide excellent performance, convenience and reliability. To get the best use from your instrument and to ensure its safe operation, please spend a few minutes to read this manual.

Made in Australia. International Patents Granted
© Copyright Kingfisher International Pty Ltd
6th Edition, November 2014

CONTENTS

Service and Support 6
Introduction and Applications 7
General Safety Summary 10
Battery and External Power 13
Push On Optical Connector 15
Screw On Optical Connector 17
Getting Started And Turning On 18
Setting Date and Time 21
Autotest 22
Patch-lead Test Using Loss Test Meter 23
Manual Operation-Power Meter 24
Manual Operation-Light Source 25
Visible Laser Operation 26
Tone Detection And Slow Mode 27
Text ID tag 28
Recording, Storing, Recalling Readings and Clearing Memory 29
PC Interface And External Software 32
Care Of Your Instrument 34
Accuracy Considerations 35
Definition of Terms 38
Specifications 39
Ordering Information 47
Calibration and Maintenance 51
Performance Verification Tests 53
Quick Reference Guide 66
Disclaimer and Warranty 68
User Notes 69

Flip-over connector cover & tilt bail
On/Off
Backlight
Connector Release & Port Identifier
Lugs for Carry Strap
Micro USB port for data and power
Store
USB port for memory stick
Memory Text ID
Battery compartment
[F1]
[F4]
Toggle centre
KINGFISHER INTERNATIONAL
Optical Power Meter
Model KI1200E
Serial TRIAL RUN
Kingfisher International Pty Ltd
www.kingfisher.com.au
No user adjustable parts inside
Made in Australia
Remove adaptor: Press [release button] and pull off adaptor
Disable Auto-Off Timer: Hold [On] for 3 seconds
Enter Meter or VFL / return Home: Press [Meter] or [Source] / [Home]
Change wavelength: Press [<] or [>]
Select log / linear / relative: Press [Mode]
Set reference: Hold [Set Ref] for 3 seconds
Store to memory: Press [Store] (top right λ key)
Read memory: Press [<] or [>]
Save to USB: Insert i-memory stick, Press [Store]
Clear memory: Hold Button centre key, and press [Off]
Autotest is started from light source
1310 nm -0.27 dB R
1490 nm -23.81 dB R
1550 nm -0.28 dB R
Source
Memory
Meter
Auto Hold
KINGFISHER INTERNATIONAL
Hand Held Fiber Meter

KI2600 SERIES OPTICAL POWER METER

KINGFISHER INTERNATIONAL
Optical Light Source
Model KI 28624-APC
Serial 0000
Kingfisher International Pty Ltd
www.kingfisher.com.au
No user adjustable parts inside
Made in Australia
Remove adaptor: Press [release button] and pull off adaptor
Disable Auto-Off Timer: Hold [On] for 3 seconds
Enter Meter or VFL / return Home: Press [Meter] or [Source] / [Home]
Change wavelength: Press [<] or [>]
Select log / linear / relative: Press [Mode]
Set reference: Hold [Set Ref] for 3 seconds
Store to memory: Press [Store] (top right Δ key)
Read memory: Press [<] or [>]
Save to USB: Insert memory stick, Press [Store]
Clear memory: Hold Button centre key, and press [Off]
Autotest is started from light source
1550nm
-5.00dBm
On
Source Home
Mode
Auto
KINGFISHER INTERNATIONAL
Hand Held Fiber Source

KI2400/2800 HAND HELD FIBER SOURCE

KINGFISHER INTERNATIONAL
Optical Loss Test Set
Model KI 27624–Ge
Serial 0000
Kingfisher International Pty Ltd
www.kingfisher.com.au
No user adjustable parts inside
Made in Australia
Remove adaptor: Press [release button] and pull off adaptor
Disable Auto-Off Timer: Hold [On] for 3 seconds
Enter Meter or VFL / return Home: Press [Meter] or [Source] / [Home]
Change wavelength: Press [<] or [>]
Select log / linear / relative: Press [Mode]
Set reference: Hold [Set Ref] for 3 seconds
Store to memory: Press [Store] (top right Λ key)
Read memory: Press [<] or [>]
Save to USB: Insert memory stick, Press [Store]
Clear memory: Hold Botton centre key, and press [Off]
Autotest is started from light source

KI2300/2700 HAND HELD LOSS TEST METER

SERVICE AND SUPPORT

Applications Support

Please visit www.kingfisherfiber.com to see our comprehensive **Application Notes** written to support instrument users, an updated version of this manual or instrument firmware updates. FAQs can be found in the "Support" section of our website.

This equipment can perform testing in accordance with TIA and IEC fiber optic test standards. Please refer to www.kingfisherfiber.com for details.

Look at www.kingfisherfiber.com to find distributor and service centre details from the **Contact Us** section.

Our local agents are able to offer excellent applications advice in your language and time zone.

Otherwise if you are having difficulties, please feel free to contact sales@kingfisher.com.au for applications support.

Instrument Service

Qualified personnel must perform adjustment, maintenance or repair of this product. To obtain service, please contact your local Kingfisher International distributor or our office in Australia:

Tel: (+61) 3-9757-4100
Fax: (+61) 3-9757-4193
Email: sales@kingfisher.com.au

If returning equipment to us for service or calibration, please download and complete the **Return Material Authorization Form** located on the **Support** page on our web site.

To avoid delays and minimise disruption for our customers, we offer a fixed price repair service.

For the staff at our fully equipped service and calibration centre, it is their pleasure to keep your equipment performing at its very best.

INTRODUCTION AND APPLICATIONS

The KI2000 Series Sources, Power Meters and Loss Test Meters are used to test all types of fiber optic systems, offering exceptional levels of convenience, productivity and accuracy. Compact, robust and reliable, these instruments are ideal for field or laboratory use by installers, technicians and engineers.

Typical Test applications:

- Optical attenuation
- Optical power
- Continuity & polarity, using the test tone features
- General quality assurance and acceptance
- Construction & maintenance in Telecom CATV, LAN, R&D.
- Full CWDM, DWDM and out of band capability

The Fiber Power Meters are also available with a VFL fault finder, or large area (XL) detector. The Fiber Light Sources are also available with a VisiTest red laser. Loss Test Meters are a combination of these two instruments.

Autotest communicates test data between instruments to automate loss testing, and is generally compatible with other series of Kingfisher Autotest instruments.

The instruments feature excellent test accuracy, while the zero warm up source options provide exceptional source stability for demanding test situations. The innovative VisiTest option is helpful for general loss testing, continuity testing and fault finding.

The instruments are simple to operate, with convenient menus to guide the user through operational sequences. The large, clear, sunlight readable and backlit LCD is an exceptional feature.

The instrument interchangeable optical connectors are protected by a dust cover which also flips over to serve as a handy tilt bail. A wide variety of connector styles are available.

The tough polycarbonate housing has shock absorbing rubber for drop protection. The very latest materials and methods have been used to produce an elegant, yet rugged instrument.

These instruments feature excellent battery life: 1000 hours for the power meter and 80 hours for light source from just 2 x AA alkaline or NiMh cells.

Instruments can be externally powered or charged via micro USB. Most users will already have suitable USB chargers to hand, since they are commonly used on mobile phones and other devices.

Memory and External Software Features

Test results can be stored in the large memory along with text-input cable name and timestamp, and then dumped onto a USB memory stick (or a phone micro SD card using a suitable adaptor), via the Type A USB port. This is a very simple and convenient way to store and transmit test data from a site. This download method is also independent of any operating system.

Alternatively, KITS™ reporting software allows real-time instrument control and data download, and is easily customised to suit most

languages and reporting requirements. Real time display and data logging is included. KITS™ enables merging of test results from multiple instruments and supports bi-directional testing for one way equipment using successive measurements.

Power Meter Measurement Capability

Calibration accuracy is amongst the best in the industry

Superior operational accuracy is proven with a unique Total Uncertainty Specification, which covers the full temperature, dynamic and connector range.

Warm up period, range-changing delays and user dark current zeroing are all eliminated.

The sensitive optical tone detector displays the actual measured tone frequency in Hz. If a standard tone is detected, the buzzer sounds, which is useful for fiber identification and continuity testing. The MultiFiber ID feature provides unique continuity / polarity identification of up to 12 fibers.

Power stability testing over a period can be performed using the max/min recording function.

The display shows dBm, dB mW, µW, nW, to 0.01 dB resolution, and can be put on hold for convenient manual data recording.

A separate reference for each wavelength is stored and displayed.

When performing loss testing using an Autotest light source, up to three wavelengths are displayed simultaneously. More wavelengths are shown with a scrolling display.

Power Meters with standard detectors work with fiber core diameter up to 200 micron, with both PC and APC polish connectors.

Power meters with Large Area Detectors work with an active fiber core diameter up to 3 mm. Common applications include ribbon fiber MPO/MTP and POF / HCS etc.

Various detector options include Indium Gallium Arsenide (InGaAs), Germanium (Ge), Silicon (Si) and high power versions.

Power meter calibration options are available from 635 nm to 1650 nm, which cover all popular application wavelengths, including CWDM calibrations from 1270 nm to 1610 nm in 20 nm increments. Power range options are from +33dBm to -70dBm.

The instrument calibration wavelengths are all genuine. There are no interpolated or inferred calibration values. In order to achieve this, a unique automated calibration system is used during manufacture.

The KI2601 power meter range includes a 650 nm visible laser for extra convenience when locating faults.

Light Source

Multiple wavelength sources have switchable wavelengths through one port, which makes operation faster.

Laser sources at 1310 / 1490 / 1550 / 1625 nm are used for testing single mode fiber systems, and LED sources at 850 / 1300 nm are used for testing multimode fiber systems. The innovative VisiTest option is helpful for general loss testing, continuity testing and fault finding.

LED sources are mode controlled and compliant with Encircled Flux & CPR test standards. The 1300 nm LED can also perform short distance single mode testing.

Laser / LED light sources have re-connection repeatability of 0.1dB / 0.05 dB. Combined with the instrument excellent stability, this provides more accurate measurement results.

Multi-fiber ID allows for easy multi-fiber identification of up to 12 fibers at a time. To use this feature, multiple light sources are set up on multiple fibers, with each one set to a different tone. When a tone is detected by a power meter, a buzzer sounds and the corresponding fiber ID number is displayed.

KI2400 series include zero warm up ultra stable laser and LED light sources with laser stability of ± 0.03 dB.

GENERAL SAFETY SUMMARY

The following safety signs and symbols specify general safety precautions which must be observed during all phases of operation, service and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture and intended use of the instrument. Kingfisher International assumes no liability for the customer's failure to comply with these requirements.

Before operation, review the instrument and user manual for safety instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

WARNING!

The **WARNING!** sign denotes a hazard. It calls attention to a procedure, practice or the like, which, if not correctly performed or adhered to, could result in injury. Do not proceed beyond a **WARNING!** sign until the indicated safety conditions are fully understood and met.

CAUTION!

The **CAUTION!** sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part, or all, of the product. Do not proceed beyond a **CAUTION!** sign until the indicated conditions are fully understood and met.

The apparatus will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the apparatus against damage.

Initial Inspection

Inspect the shipping container for damage. If there is damage to the container or cushioning, keep them until you have checked the contents of the shipment for completeness and verified the instrument both mechanically and electrically. If the contents are incomplete, mechanical damage or defect is apparent, or if an instrument does not pass the operator's checks, notify the nearest Sales/Service Office.

To check instrument performance, please refer to **Performance Verification Tests** section of this manual.

WARNING! You must return a malfunctioning instrument to an authorised Service Centre for repair and calibration.

Operating Environment

The range of Kingfisher equipment covered by this manual can be operated at temperatures between -15 °C and +55 °C and at relative humidity of <95 %.

Storage & Shipment

The range of Kingfisher equipment covered by this manual can be stored or shipped at temperatures between -25 °C and +70 °C and at relative humidity of less than 95 %. Protect the units from temperature extremes that may cause condensation within it.

Safety

An Optical Power Meter contains no hazardous optical or electrical items. When using this equipment, optical safety precautions should be observed commensurate with the maximum available optical source power.

WARNING!

A VFL (an option also available on Optical Power Meters) or LED / laser source is an optical hazard, and appropriate optical safety precautions must be observed. Relevant user safety information is given in following pages. There are no hazardous electrical items, however unauthorized modification of the circuits and settings could create a hazardous optical condition. So for service, these devices must be returned to an authorised service centre, and unauthorised modification or adjustment must not be performed.

WARNING! Observe optical safety when using high power.

Optical safety requirements at high power levels **MUST** be observed or eye damage is likely. Organisations and users operating optical equipment with these power levels **MUST** determine and observe relevant safety precautions, which are beyond the scope of this manual:

WARNING!

Optical power levels in fiber optic systems can cause permanent eye injury and damage to eyesight. Risk is greatly increased by availability of simple magnifiers without safety filters.

GENERAL SAFETY SUMMARY

Laser and LED Safety Information

Wavelength	
Visual laser	650 ±5 nm
Surface emitting LED	850nm/1300±20 nm
Fabry - Perot laser	1310 / 1550 / 1625 ±20 nm
Ultra stable LED	1310 / 1550 nm

Max CW output power[1]	
650 nm	1.6 mW
850/1300 nm	0.01 mW
1310 / 1490/ 1550 / 1625 nm (laser)	0.5mW
1310 / 1550 nm (Laser)	1mW
1310 / 1550 (ultra stable LED)	0.01mW

Hazard level	
IEC 60825-2 (2011) – International	
650	class 1
850 / 1300 / 1310 / 1550 / 1625 nm	class 1
21 CFR 1040.10 (1995) – USA	
650 nm (assumed subject to review)	class 3a
850 /1300 / 1310 / 1550 / 1625 nm	class 1

Maximum permissible CW output power[2]	
IEC 60825-2 (2011) - International	
650 nm, class 2M	10 mW
850 nm, class 1	3.88 mW
1310 nm, MM, class 1	77.8 mW
1310 nm, SM, class 1	25.8 mW
1550 nm, SM, class 1	10.2 mW
21 CFR 1040.10 (1995) – USA	
650 nm, Class 3b	5 mW
1310 nm, Class 2	2 mW
1490/1550 nm, Class 2	8.1 mW

Note 1: Maximum CW output power is defined as the highest possible optical power that the Source can produce at its output connector. Refer to specification sheet for actual operating power.

Note 2: Maximum permissible CW output power is the highest optical power that is permitted within the appropriate laser class. Refer to specification sheet for actual operating power

BATTERY AND EXTERNAL POWER

These instruments are powered by two 'AA' size batteries, either non rechargeable 1.5V alkaline or lithium; or rechargeable NiMh with jumper selected charging.

For operation of the instrument by external power, connect the instrument micro USB port to a computer or USB power pack via a suitable micro USB cable.

Instrument Function	Battery run time in hours:
Optical Power Meter	1000
Optical Light Source	80

The battery condition indicator shows 4 levels of battery state. When the battery indication is low, there is approximately enough energy for another 10 hours of use (Power Meter). This battery symbol shows when external power is not connected

To save energy, the instrument automatically turns off after 10 minutes without operation.

This battery symbol shows when external power is connected.

To change the batteries, open the cover of the battery compartment at the base of the instrument, remove the batteries, insert new ones (check polarity indication on plastic case) and close the cover again.

If the batteries are changed quickly, instrument date and time are retained, however if the batteries are taken out for longer or are finished, then date and time will need re-entering.

Enabling Battery Charging

As delivered, use of external power disconnects the batteries as a safety precaution, since accidental charging of alkaline cells is hazardous.

However, users who are **only** going to use re-chargeable batteries can enable the battery charging feature by inserting a programming jumper onto charging pins in the battery compartment, Figure 1. Attempting to recharge normal alkaline batteries may lead to acid leakage and instrument damage.

To Enable Charging Feature: The programming jumper is placed to link the two left pins, Figure 1A.

To Disable Charging Feature: The programming jumper can be either removed, or stored across the two right pins, Figure 1B. If charging is definitely not required, remove the jumper altogether.

In charging mode, the batteries can charge when the instrument is turned off.

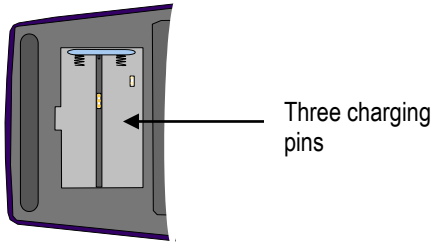


Figure 1. View inside battery compartment

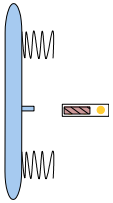


Figure 1A. To enable charging, programming jumper links two left pins

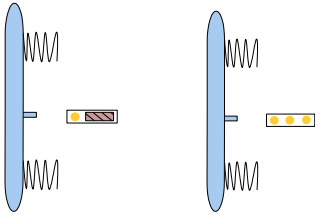


Figure 1B. To disable charging, programming jumper can be stored across two right pins or removed.

CAUTION!

Do not use batteries with a nominal voltage greater than 1.8 V. The instrument may be damaged.

Do not mix battery types.

Do not use rechargeable lithium-ion batteries, the voltage is too high and will damage the instrument.

Do not set up the instrument to charge non-rechargeable batteries, or damage may result.

Protect our environment! Some batteries contain toxic heavy metals, so please dispose of them by returning to a re-cycling centre. Batteries purchased from Kingfisher agents can be returned to them for appropriate disposal.

PUSH ON OPTICAL CONNECTOR

This section applies to instruments with push-on pull-off interchangeable optical adaptors.

To access the optical connector, grasp the grey cover on the top of the instrument and tilt it back. The cover can then be pushed back to form a convenient tilt bail for the instrument.

Different styles of standard and optional connector adaptors can be easily fitted by the user.

A fitted connector may be easier to remove if a patch lead is attached, since then it is easier to grasp it.

To remove the fitted connector, simply pull of the connector while gently depressing the adjacent connector release button. Excessive force is not required.

The supplied standard connector adaptor has a ceramic sleeve to avoid connector metal dust contamination of the target system.

When not in use, keep test ports and connectors covered. Never touch connector tips with your fingers, since body oils and dirt can impair performance.

CAUTION! Do not use damaged or incompatible connector adaptors.

WARNING! Remove batteries before using a microscope to inspect instrument connectors.

Power Meter:

This port can be used with both PC and APC connector styles.

Bare fiber adaptors must achieve fiber eccentricity of ± 100 microns, and end tolerance of ± 300 microns relative to the ferrule end. Preferred bare fiber adaptors consist of a connector with fiber retention device or other end stop.

For regular work with bare fibers it is preferable to use an alternative arrangement such as a multimode pigtail with a v-groove or mechanical splice.

CAUTION! Do not scratch the detector lens with glass fiber end when using bare fiber adaptors, otherwise instrument will be permanently damaged.

Light Source:

A Light Source connector is either PC or APC polish. This is determined when ordering the instrument, and can only be changed at the factory.

CAUTION! The use of bare fiber adaptors with any source port is not recommended as permanent instrument damage may occur, and very unstable measurements are likely.

PUSH ON OPTICAL CONNECTOR

How to clean the optical connectors

Always clean the mating connector tip and ferrule before mating, using approved materials.

CAUTION! Never use abrasive cleaners or permanent instrument damage may occur.

Power Meter:

The recessed glass power meter interface does not make contact with inserted connectors; there is a slight air gap. Therefore, it will not wear and only needs occasional cleaning.

First remove the interchangeable connector adaptor, then use a soft brush, alcohol, air can, or 'Blu Tac' to clean the recessed glass interface.

Light Source:

WARNING! Disable source when cleaning optical interfaces.

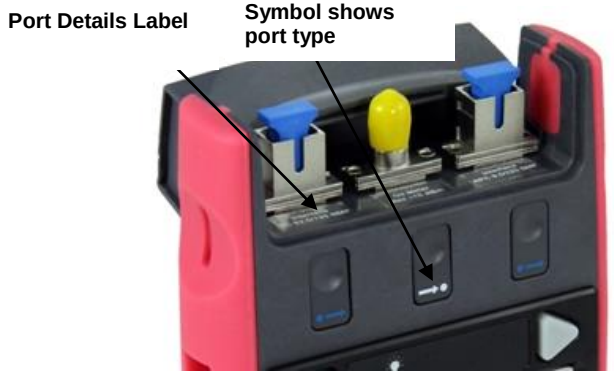
To clean the interface without removing the adaptor, use a "stick" style connector cleaner. This cleans both the adaptor and end face in one operation.

Alternatively, first remove the interchangeable adaptor to access the optical interface. Then blow away any dust or dirt with compressed air. If this is not sufficient, then clean the interface by rubbing a lint-free lens cloth over the surface using small circular movements.

Connector Wear: Fiber Optic Connectors usually have a design life of around 1,000 insertions before they are worn out.

So, if your instrument has had considerable use, the removable connector adaptor may be worn out and need replacing.

CAUTION! FC style through connectors fail easily. The problem is that the connector anti-rotation spigot can be mis-aligned, but the screwed housing can still be tightened. This is a fault in the connector design that is beyond our control, users must just be aware of the problem. Usually, the result is that ceramic sleeve inside the instrument adaptor gets broken.



SCREW ON OPTICAL CONNECTOR

This section applies to power meters with large area detectors and screw-on interchangeable optical adaptors.

To access the optical connector, grasp the grey cover on the top of the instrument and tilt it back. The cover can then be pushed back to form a convenient tilt bail for the instrument.

To remove the fitted adaptor, simply unscrew it.

Different styles of standard and optional connector adaptors can be easily fitted by the user.

CAUTION! Be careful of the optical detector when the connector adaptor is removed. It is vulnerable to damage by static electricity, or damage to the exposed detector cover glass.

CAUTION! Ensure that inserted connectors do not project through the adaptor and push on the glass detector cover, or instrument damage will occur.

These meters can be used with low-precision bare fiber adaptors.

CAUTION! Do not scratch the detector lens with glass fiber end when using bare fiber adaptors, otherwise instrument will be permanently damaged.

How to clean the optical connectors

Always clean the mating connector tip and ferrule before mating, using approved materials.

CAUTION! Never use abrasive cleaners or permanent detector damage may occur.

This port can be used with both PC and APC connector styles

The power meter interface does not make contact with the inserted connector; there is a slight air gap. Therefore, it will not wear and only needs occasional cleaning.

To clean:

- Unscrew the connector adaptor, then use a soft brush, alcohol, air can, or 'Blu Tac' to clean the glass interface, and inspect for cleanliness.
- Using compressed air, blow out the hole in the connector adaptor, and inspect for cleanliness.

Note: POF users may need to enlarge the connector exit hole on some connector adaptors that were not specifically designed for POF usage. If this hole is too small, measured powers will be low.

GETTING STARTED AND TURNING ON

This section shows basic instrument operation.

To add a carry strap, slip the end of a strap through the eyes on the on the sides of the instrument, and secure the buckle.

Install the batteries, or plug in a computer / external power pack via the micro USB connector, marked “DC-PWR-IN”. The large USB connector is not a power input.

The instrument’s optical connector is protected by a dust cover which also serves as a tilt bail. To access the optical connector, grasp the grey cover on the top of the instrument and tilt it back. Push the cover back to form a tilt bail.

Autotest operation is started from the light source.

Push-on style connectors:

To remove a connector adaptor, gently press and hold down the release button on the front of the instrument, while pulling off the adaptor. It is easier to pull off the adaptor with a test lead in place, since this gives better grip.

To install a connector adaptor, position it in such a way that you are facing a locating slot on the side of the adaptor (SC end). This will allow you to align the locating slot with that on the instrument SC connector, and then press it in.

Power Meter

To turn on the Power Meter, press [On/Off] (square green button in the top row).

Or to turn on the Power Meter for permanent operation, press the [On/Off] for 3 seconds until ‘on’ and ‘Perm’ is displayed

If the battery is low, this will be indicated by the bars on the display battery symbol.

The initial display shows the date, time, optical power and previous test wavelength.

Refer to page 21 for instructions on how to set date and time, or continue:

- Press [Meter].
- Press [-] or [+] to select another test wavelength.
- Press [Meter Mode] to select dBm etc.

  You are now using the instrument as a power meter displaying dBm.

  To set reference, enter relative mode, then hold down [Set Ref] for 3 seconds until the instrument beeps finish. The main display will go to approximately 0 dB, and the reference value will be displayed on the left hand side of the display.
- To backlight the display, press [Backlight], (top row).
- To turn the instrument off, press [On/Off] again.

Also at turn-on:

- To disable auto-off timer, hold [On] for 3 sec.
- To set time & date, hold down [Toggle centre].
- To view firmware version, hold [F4].

- To disable or activate beeping, hold [F2].
- To enter SlowMode, hold down [F3].

Light Source

To turn on the Light Source, press [On/Off] (square green button in the top row).

Or to turn on the Light Source for permanent operation, press the [On/Off] for 3 seconds until 'on' and 'Perm' is displayed

If the battery is low, this will be indicated with a battery symbol on the display.

The initial display shows the date and time.

Refer to page 21 for instructions on how to set date and time, or continue:

- Press [Source].

  You are now using instrument as a light source displaying operating wavelength, nm and nominal output power, dBm.
- Press [-] or [+] to select another operating wavelength.
- To backlight the display, press [Backlight], (top row).
- To turn the instrument off, press [On/Off] again.

Also at turn-on:

- To disable auto-off timer, hold [On] for 3 sec.
- To set time & date, hold down [Toggle centre].
- To view firmware version, hold [F4].
- To disable or activate beeping, hold [F2].

Loss Test Meter

To turn on the Loss Test Meter, press [On/Off] (square green button in the top row).

Or to turn on the Loss Test Meter for permanent operation, press the [On/Off] for 3 seconds until 'on' and 'Perm' is displayed

If the battery is low, this will be indicated with a battery symbol on the display.

The initial display shows the date, time, optical power and previous test wavelength.

Refer to page 21 for instructions on how to set date and time, or continue:

- To use instrument as a Power Meter, press [Meter] and follow the above instructions for Power Meter.
- To use instrument as a Light Source, press [Source] and follow the above instructions for Light Source.
- To use instrument as Loss Test Meter, press [Auto] to activate Autotest. Then set reference on meter, following the instructions for Power Meter.

  You are now using the instrument as a loss test meter meter displaying reference wavelengths and optical loss power in dBm.

- To backlight the display, press [Backlight], (top row).
- To turn the instrument off, press [On/Off] again.

Also at turn-on:

- To disable auto-off timer, hold [On] for 3 sec.
- To set time & date, hold down [Toggle centre].
- To view firmware version, hold [F4].
- To disable or activate beeping, hold [F2].

Instrument Hard Re-start

Should the instrument fail to turn on, the microprocessor may need re-booting. To do this, remove the batteries and any other external power for at least 10 seconds.

SETTING DATE AND TIME

Test date and time are stored with test results. So if the instrument memory or KITS software are used to record results, the user will probably want to set the date and time.

If the instrument loses power for some time, date and time will be lost and will need to be re-entered.

The instrument shows date and time at start up. Note the date is presented in a way that avoids problems with date / time formats, eg "Jan 02"

Changing date and time:

- Turn on instrument while holding down [Toggle centre] (bottom row, large square button in the middle).
- To modify the selected time/date, press [-] or [+].
- To select next/last time and date item, press [Toggle centre] or [Mode], next item will flash.
- To save new time and date settings, press [Memory].
- To exit without saving new settings, press [Home].

AUTOTEST

Autotest performs automated loss measurement and wavelength detection by data exchange between a Light Source and Optical Power meter. Major labour savings can be achieved.

Autotest detection remains activated for about 8 seconds after fiber disconnect, so the user can change optical connections without re-starting Autotest each time, thus achieving productivity gains. Autotest reduces source warm up drift and battery consumption compared to manual operation.

To realise the full benefit of Autotest, please consider using KITS™ software to achieve real-time data acquisition, and to facilitate acceptance testing and reporting in the field.

Autotest works in situations where high loss or wavelength selective elements stop some wavelengths from transmitting. The meter will detect and show whatever wavelengths are successfully received.

Instrument compatibility

Any Kingfisher Autotest source / power meter / loss test set / two-way tester can be used as a source & meter, for one direction loss testing. Both instruments must have matching source and meter wavelengths.

The excellent stability of Kingfisher light sources is highly relevant to Autotest operation, since the requirement to re-reference the source & meter is greatly reduced compared to most other equipment.

Initiating Autotest

Connect a light source to a power meter with an appropriate test lead, and turn on the instruments. On the **light source**, press [Auto], the light source will cycle through all available wavelengths (limited to 5*) and the meter will automatically switch to Autotest mode. The meter detects the correct wavelengths, and displays the nominal source power in dBm, with the wavelengths shown at the left hand side of the display. Up to three wavelengths can be displayed at the same time. To indicate Autotest is on, 'Auto' will be flashing.

Autotest Operation

- Press 'Hold' to stop/allow display update.
- To toggle logarithmic / linear / relative display mode, press [Meter Mode]. Measured optical power will be displayed in 'dBm', 'µW' or 'dB R'.
- To view the nominal source power, press [Meter Mode] to enter 'dBm' or 'µW', then press and hold [+].
- To set reference, press [Meter Mode] to enter dB R, then press and hold [Set Ref] for 3 seconds until beeps stop.
- To view reference value, press [Meter Mode] to enter dB R, then press [+].
- To exit Autotest, press [Home] on light source or disconnect patch lead for more than 8 seconds.

***** For light source with more than 5 wavelengths (or more than 3 wavelengths which are beyond 1300nm):

- hold [-] then press [Auto] to enter Autotest mode for MMF port only.

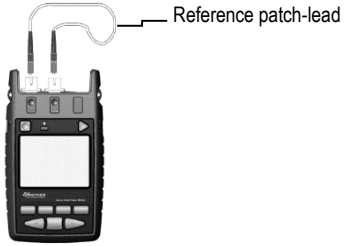
- hold [+] then press [Auto] to enter Autotest mode for SMF port only.

- press just [Auto] will enter Autotest mode for SMF port only.

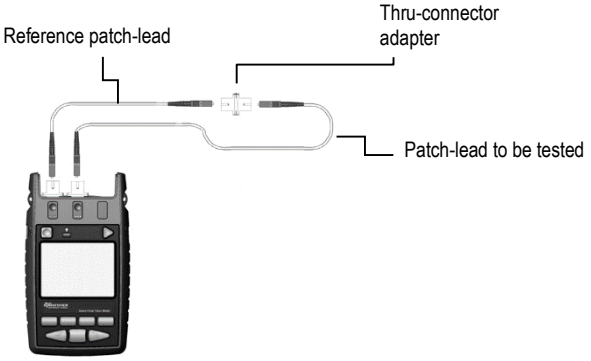
PATCH-LEAD TEST USING LOSS TEST METER

This section illustrates the instruction to use Loss Test Meter to perform simple IL (Insertion Loss) measurement on a patch-lead.

1. Connect a reference patch-lead (test grade) between the light source and power meter ports of Loss Test Meter as shown below;



2. Switch on the Loss Test Meter and press [AUTOTEST].
3. Set measurement reference: press [Meter Mode] to enter dB R, then press and hold [Set Ref] for 3 seconds until beeps stop.
4. Remove reference patch-lead connection at power meter port, connect reference patch-lead to the patch-lead to be tested via a thru-connector adapter, connect the free end of patch-lead to be tested to power meter port.



5. Read IL (in dB R mode) of the respective wavelengths displayed on instrument.

MANUAL OPERATION-POWER METER

This section summarises manual operation of the KI2600 Series Power Meter, most used when performing absolute power measurements on transmission equipment, or if Autotest is not available.

At turn-on:

- To operate Meter, press [Meter].
- 'HI' or 'LO' indicate the input power level is out of range.
- Absolute power level can be measured in dBm, or linear mode. Optical loss or attenuation is measured in dB.
- To toggle logarithmic / linear / relative display mode, press [Meter Mode]. Measured optical power will be displayed in 'dBm', 'µW' or 'dB R'.
- To scroll calibration wavelengths, press [-] or [+]. The display shows the active calibration wavelength in nm.
- To set reference: In relative mode, hold down [Set Ref] for 3 seconds until the instrument beeps finish. Then the main display will go to approximately 0 dB, and the reference value will be displayed on the left hand side of the display.
- To stop / start display update, press [Hold]. The symbol will flash when the display is on hold.
- To store to memory, press [►] (top row, yellow triangular button) Please refer to "Recording, Storing, Recalling Readings and Clearing Memory" section for detailed memory operation.
- To display, hide or reset minimum and maximum recorded power for selected wavelength, press [-] and [+] simultaneously. Alternatively, to reset this function, press and hold [Mode], then press [On/Off] or change wavelength, or exit Meter menu. This is a handy data logging function for field use.
- Press [Home] to return to start menu

On rare occasions where the meter is unable to display a power level and displays a tone instead, refer to "SlowMode" section in this manual, to set the meter to averaging mode.

This section summarises manual and advanced Autotest operation of the Light Source. For general Autotest, refer to the Autotest section.

- Press [Source].
- Press [-] or [+] to select another operating wavelength.
- To change power level, press and hold [F2] then use [-] or [+] (laser light source only, not available for LED sources)
- To restore default power level, press [F2] then press [Toggle centre] (laser light source only, not available for LED sources)
- To select modulation while source is on, press and release [Mode]. Press [Mode] again to select next available frequency or ID-tone. Alternatively, press and hold [Mode] then use [-] or [+] to cycle through all options.
- To end modulation, press and hold [Mode] then press [Toggle centre]. Alternatively, press and hold [Mode] for 3 sec.

Autotest Advanced Feature: Limited Wavelength Mode

This is a useful way to simplify testing, if only one or more wavelengths is actually wanted.

- To check wavelength status, eg if it is selected for limited wavelength AutoTest, press [F4] while source is on.
- To toggle selection of wavelengths for limited wavelength AutoTest, press and hold [Toggle centre] then press [F4] while source is on.
- To start limited wavelength AutoTest, press and hold [Toggle centre], then press [Auto].

VISIBLE LASER OPERATION

This is applicable to KI2800 and KI2601 Series instruments.

A visible laser is a useful low skill fault finding tool and is either PC or APC connector-specific. This is determined when ordering the instrument, and can only be changed at the factory.

In practice, due to the low precision of the connection, APC connectors can usually be used with a VFL that has a PC connector.

CAUTION!

When working with PC/ APC mis-matched connectors, rough connector handling can result in connector damage.

The visible laser works equally well in single mode and multimode systems. Although red light is visible at the fiber end up to about 5km, best performance will be achieved over distances of less than 1km.

If the laser light is inserted into a faulty system, the fault point will glow red visible through most 3mm patch lead jackets. Please note this should be tested before proceeding as some types of patch lead jackets absorb light. It is also generally possible to locate faulty connectors in the same way.

KI2601 Series:

To switch on the visible laser, press [On] then [SOURCE].

To improve visibility, the laser is modulated at 2Hz. To change modulation frequency, press and release [Mode] while source is on.

VisiTester:

VisiTester is activated automatically when the relevant source port is equipped with VFL: a visible light sequence is included in the test sequence. When performing sequential loss testing it's then obvious where the light source has been plugged in. For fault finding the combined red / infra red signal allows both VFL inspection and clip-on fiber identifiers to be used with the same source hook-up, giving up to 200Km of fault finding range in the one hook-up.

The VisiTester laser can also be activated manually for simple fault finding activities.

WARNING!

Although the visible laser, classified as Class 1, is eye safe, please observe required optical safety measures.

TONE DETECTION AND SLOW MODE

Tone detection

This is a very useful feature for quick continuity / polarity checking. It provides a number of practical options.

- If a standard optical test tone is detected (e.g. 270 Hz, 1 KHz, 2 KHz), a buzzer will sound and the display will change to show the actual measured modulation frequency in Hz. This is useful for fiber identification and signalling.
- If a non-standard optical test tone is detected the display will change to show the actual measured modulation frequency in Hz. This is useful for fiber identification and signalling.
- The meter can be used to check the actual modulation frequency of test sources (between 150 and 9999 Hz).
- If a MultiFiber ID tone is detected, a buzzer will sound and the corresponding fiber ID xx number (1 – 12) will be displayed. To use this feature, one or more sources with MultiFiber ID are required. This is a very useful feature for quick ribbon fiber polarity checking. It can also be used to send one of 12 pre-coded signals between test staff.

SlowMode

Slow mode is occasionally used to measure power on unstable signals that accidentally trigger tone detection. In this mode, Autotest and tone detection are disabled, and measurement integration time is extended

- In SlowMode, the display will show average optical power of the modulated signal.
- To enter SlowMode, during turn on, hold down [F3] (button located in the middle row right from the centre). '-tonE' will be displayed briefly. After releasing [F3], the symbol of "∞" will be displayed to indicate SlowMode has been activated.
- Alternatively, to turn SlowMode on/off while in Meter Menu, press and hold [Meter Mode] then press [F4].
- To turn SlowMode on while in Tone detection mode, press [F4]. This will disable tone detection.

  To turn it off, press and hold [Meter Mode] while pressing [F4].

TEXT ID Tag

Text ID tag is useful pre-set feature to systematically add text names to test results in memory.

Note that this instruction does not refer to storing of test results; it refers to setting up a collection of user defined names that can be conveniently recalled as needed.

A Text ID tag is formed by 4 letters and a 3 digit fiber index, eg. ABCD001. The last 3 numbers auto-increment as results are stored.

Up to 20 user-created Text ID Tags can be stored. A new Text ID Tag can be created or modified while in Meter menu or in AutoTest.

To create a new Text ID Tag

- Enter Meter menu.
- Press [Toggle centre], then [F4]. You will see a new ID Tag, AAAA001, with the 1st character flashing.
- Press [-] or [+] to select new alphanumeric character, then press [Toggle centre] to move to the next.
- Press [F3] to reset the digit fiber index to '001'.
- To exit with saving, press [Memory].
- To exit without saving, press [Home].

To modify an existing Text ID Tag

- Enter Meter menu.
- Press [Toggle centre], then [-] or [+] to select a stored ID Tag.
- Press [F3], the character to be edited will flash.
- Press [-] or [+] to select new alphanumeric character, then press [Toggle centre] to move to the next.
- Press [F3] to reset the digit fiber index to '001'
- To exit with saving, press [Memory].
- To exit without saving, press [Home].

To delete a Text ID Tag

- Enter Meter menu.
- Press [Toggle centre], then [-] or [+] to select a stored ID Tag.
- Press [F3]. Press [F4].
- To exit with saving, press [Memory].
- To exit without saving, press [Home].

To use a stored Text ID Tag

- Enter Meter menu.
- Press [Toggle centre]. ID Tag will flash.
- Press [-] or [+] to select.

Each time the tag is used to store data in memory, the last 3 numbers will auto-increment. This incremented number is also recalled if this tag is called again, or the instrument is turned on again.

TEXT ID Tag

Note: Text ID tag detail is independent of the actual memory location within the instrument. An identical Text ID tag number can be re-used, and it will store in the next available empty memory location.

Text ID tags can only be deleted one at a time.

RECORDING, STORING, RECALLING READINGS AND CLEARING MEMORY

KI2600 Series instruments provide various options for storing and recording data.

Meter Reference Value

The power meter reference value for each wavelength is stored in non-volatile memory. It is displayed on the left of the display when in relative mode and if in Autotest, while [+] is held down.

Meter Display Hold

To hold the display at its current value, press [HOLD]. To continue updating the display, press [Hold] again.

Automatic MAX / MIN Recording

While in Max/Min display mode, the maximum and minimum power meter values are continuously recorded in real time. To display or hide minimum and maximum recorded values, press [-] and [+] simultaneously. This function is disabled in Autotest.

User Setting Retention

Some convenient user settings are stored at instrument turn-off, and restored when the instrument is turned back on.

User Memory

The non-volatile user memory stores test data, which can then be displayed or downloaded to the spreadsheet in the KITS™ software or saved to a USB stick.

Overview of User Memory stored data:

Data stored in Power Meter and Autotest mode:

- measured optical power in dBm, W, dB R
- reference value, dBm
- detected wavelength, nm
- time and date
- Autotest nominal source power
- Autotest relative mode references
- Text ID Tag
- Instrument serial numbers

RECORDING, STORING, RECALLING READINGS AND CLEARING MEMORY

Recording data to memory

Make sure that the required Text ID Tag is showing. If not, refer to "Text ID Tag" section.

- To record data to internal memory in Meter or Autotest modes, press [►]. Data will be stored in the next location.
- To change the next location for storage, enter Memory mode, then select the desired location, using the [+] or [-] and press and hold [Memory] for three seconds.

Note: existing memory following the selected location will be progressively overwritten.

USB Key Memory Dump

The large USB (Type A) port on the right side of the instrument with "**MEM**" (Memory) is used only for dumping a data file onto a USB memory key, it has no other function. General USB connectivity and external charging are achieved with the other micro USB port.

The instrument only detects the presence of a memory key when in memory mode, at which point "USB" shows on the LCD.

- To save memory to USB stick, enter Memory mode, then insert USB stick, and observe that "USB" shows on the display to indicate that the USB stick has been detected.
- Press [►]. Do not remove the USB stick until the download has completed and the "USB" symbol has stopped flashing.

Recalling stored data from memory

- To access memory locations and to select stored readings, enter Memory menu and press [+] or [-].
- To select 'dBm' or uW' or 'dB R' modes, press [F3].
- To view saved time and date, press and hold [Toggle centre].
- To view Autotest nominal source power, while in Memory menu, in 'uW' or 'dBm' mode only, press [F4].
- To view Autotest relative mode references, while in Memory menu, in 'dB R' mode only, press [F4].
- To distinguish between stored manual and Autotest results, Autotest results are shown with "Auto" at the top of the display.

Over-writing one result

This is often required when re-testing one item. While in Memory mode, select the desired location using the [+] or [-], then press and hold [Memory] for three seconds.

When done, remember to repeat this procedure to return to the end test sequence.

Clearing memory

A full memory is indicated by 'Full' label and beep.

To clear **all stored test data**, while in the Memory menu, press and hold [Toggle centre] then press [Off]. "clr" will be displayed on the screen. This does not clear stored Text ID Tags.

Memory capacity

Memory capacity is 999 sets of 1 - 4 wavelength measurements.

PC INTERFACE AND EXTERNAL SOFTWARE

The KI2600 Series instruments feature a micro USB interface which gives remote access and control from an external PC.

Note that the larger USB port marked “MEM” is only used to dump data onto a USB memory key, and has no other function.

When the instrument is connected to a PC or power supply via a micro USB cable, the battery symbol “ ” will be displayed as “ ”.

KITS™ software

Free KITS™ software is available on our website www.kingfisherfiber.com and enables instrument control and transfer of live or stored data to an Excel spreadsheet, making it ideal for data logging and reporting in the field. KITS™ can be easily customised to change language, terminology or to add new reporting features.

Functions currently supported by KITS™ are:

- Live Power Meter display
- Two Way loss reporting by merging one direction data
- Spreadsheet to record loss measurements with direct click-and point data insertion or memory download
- Data logging with graph and statistical information

Note: at time of instrument release, updated KITS software was not available. Availability is expected soon.

If upgraded firmware is required, please refer to our web site product page for details.

CARE OF YOUR INSTRUMENT

- Follow the directions in this manual on optical connector care.
- During prolonged storage, remove batteries to eliminate the possibility of acid leakage. Use only high quality sealed alkaline, lithium or NiMH batteries.
- During storage and transport keep the instrument in its carry case to protect against crushing, vibration, dust and moisture.
- The instrument is resistant to normal dust and moisture, however it is not waterproof. If moisture gets into the instrument, dry it out carefully before using it again. Where possible, keep instrument away from strong sunlight.
- Clean the instrument case using soft damp cloth. Do not use strong solvents to avoid risk of damage to surfaces.
- The instrument housing is made of tough polycarbonate material with impact absorbing rubberised corner features, and is therefore drop resistant.

  CAUTION! Input optical power must not exceed the damage level specified for each detector type.

Keep optical connectors clean and in good condition.

To reduce the effect of polarisation changes, the fiber system should be neat, coiled and physically stable.

In multimode systems, modal noise and general uncertainty are much worse than in single mode systems. Optimum measurement repeatability will be obtained by use of LED sources and a mandrel wrap.

Power Meter

For best absolute power testing accuracy, the meter calibration wavelength should be set close to the measured wavelength. Note that the wavelength uncertainty of the source may be 30 nm or so. Problem areas tend to be InGaAs below 1000 nm and Ge above 1550 nm.

Use of an APC connector at the power meter interface will reduce line reflections and improve measurement stability in laser based single mode systems. This is important when measuring small connector losses.

For high precision use, power meters provide better accuracy when measuring a non-coherent source such as an LED. So for best accuracy when testing small losses on single mode patch leads etc, an LED source may be preferred.

High power (attenuated) meters tend to suffer overall reduced accuracy. Kingfisher high power meters have better general accuracy than most others, since our meters use a more sophisticated attenuating element which reduces the adverse effects of reflections and wavelength sensitivity.

At levels below about -45 dBm, spurious readings can be caused by stray light leaking into fiber and patch cables. This can be a particular problem with extended range linearity measurements.

Ge power meters have limited linearity, sensitivity and accuracy compared to all other types.

Light Source

Light source power may drift. When you have finished a test, go back to the start position to check if the light source power is still within acceptable limits. Note that light source specifications are usually for typical drift after a warm up period, but the actual drift will vary between instruments and test situations.

DWDM Loss and Power Measurements

The DWDM bands are typically within 1525 ~ 1610 nm. For this application, an InGaAs detector calibrated at 1550 nm gives good absolute accuracy at all DWDM wavelengths. Testing optical loss at 1610 or 1625 nm is common, since this represents the worst case attenuation in most systems.

High power InGaAs detectors may be required to measure the system power level.

Ge detectors should not be used for accurate testing on WDM systems beyond 1550 nm, since inaccuracies become large and unpredictable.

CWDM Loss and Power Measurements

The CWDM band is from 1270 ~ 1610 nm at 20 nm spacing, however, 1490 ~ 1610 nm is more common since it avoids the water absorption peak at 1383 nm.

The most common operating wavelengths for FTTH PON systems are currently 1310 / 1490 / 1550 nm.

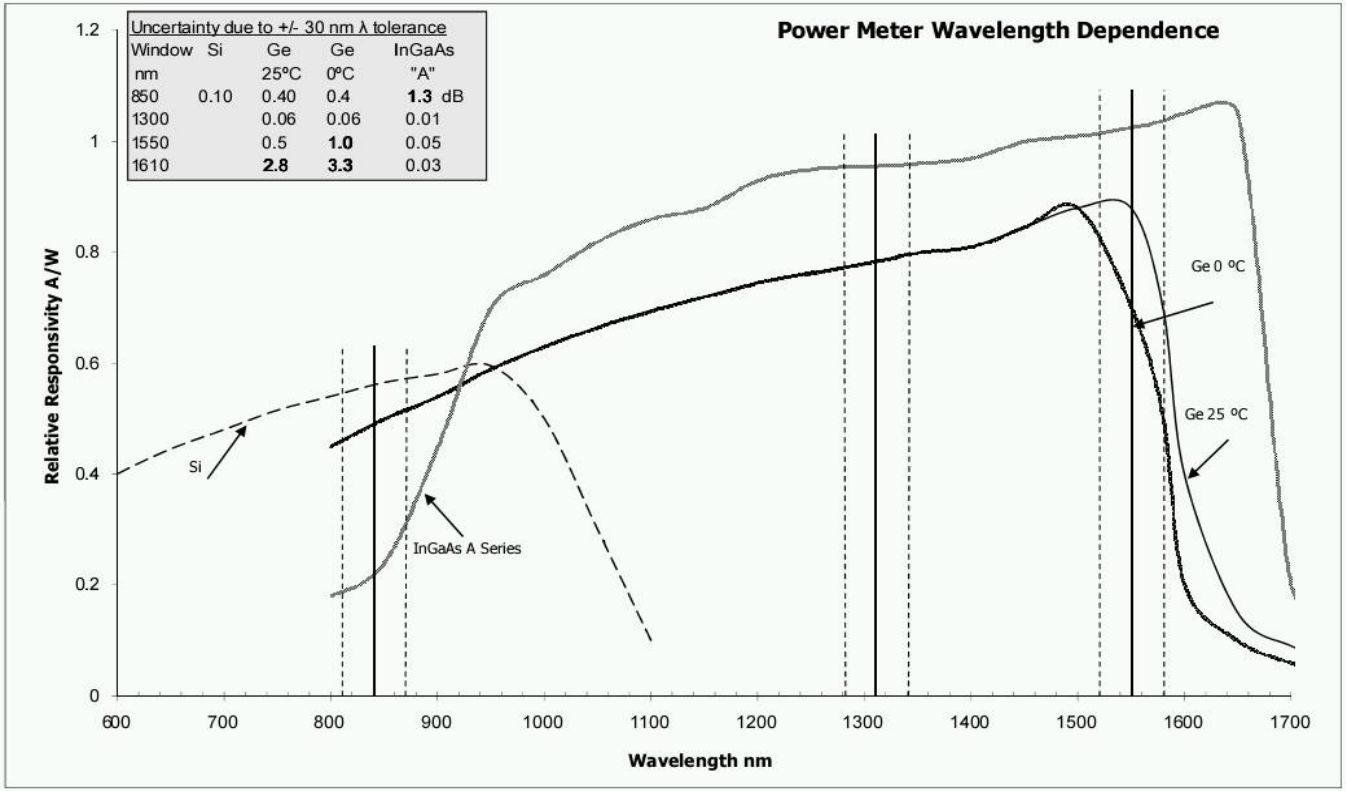
As in DWDM application, an InGaAs detector gives good absolute accuracy.

Because of the broad operating wavelengths encountered, the power meter calibration wavelength needs to be matched to the measured wavelength, or absolute errors may be excessive.

Many systems are measured at 1390 nm to test for the water peak, and at 1625 nm to measure the high end attenuation limit.

At 1625 nm, the fiber attenuation is actually very sensitive to wavelength, since the silica infra-red absorption zone is reached. So the wavelength tolerance of this particular laser is a major issue, especially since many older source instruments have a tolerance of 30 nm.

ACCURACY CONSIDERATIONS



Power Meter

Power Range: The range of input powers for which the instrument can be used.

Maximum Input Power: The input power not to be exceeded to avoid destroying the instrument.

Uncertainty at Reference Conditions: The uncertainty for the specified set of reference conditions, including all uncertainties in the calibration chain from the national laboratory to the test meter (connectors and test leads must be absolutely clean and undamaged). Reference conditions are the conditions during the responsivity calibration.

Total Uncertainty: The uncertainty for a specified set of operating conditions, including noise and drift (connectors and test leads must be absolutely clean and undamaged).

Autotest Sensitivity: The power level below which Autotest does not work.

Light Source

Output Power: The CW output power at the specified wavelength, at the end of a reference cable.

Power Uncertainty / Repeatability: Uncertainty in power level at the end of a reference cable.

Short / Long Term (Power) Stability: In CW mode, the uncertainty of the power level observed over a given time, compared to the mean power during this time. Measured with an averaging optical power meter, a 9/125µm fiber, at constant temperature, within a specified temperature window, and at line voltage.

Center wavelength: The wavelength representing the centre of mass of the selected peaks:

$$\lambda \text{ CW} = (1/\text{Po})\Sigma(\text{P}_i\,\lambda_i),$$

where Pi and λi are the power and wavelength of each spectral component and Po is the total power.

Spectral Bandwidth: FWHM (full width at half the maximum) describes the spectral width of the half-power points of the laser, assuming a Gaussian envelope of the spectral power distribution. The half-power points are those where the power-spectral density is one half of the peak amplitude of the Gaussian curve:

$$\Delta\lambda_{RMS} = \left(\frac{\Sigma\, P_i\, \lambda_i^2}{P_{total}} - \lambda_{center}^2 \right)^{1/2}$$

and

$$\Delta\lambda_{FWHM} = M\,\Delta\lambda_{RMS}$$

where: λ = center wavelength of laser diode (in vacuum)

P = ΣP_i = total power, in watts

P = power of i^{th} longitudinal mode

λ = wavelength of i^{th} longitudinal mode (in vacuum)

M = multiplication factor; for a source with a Gaussian envelope $M = 2.35$; for other types of spectra, use $M = 2.35$ as well

SPECIFICATIONS

Size:	190 x 105 x 35 mm (7.5 x 4.1 x 1.4”)
Weight:	420 gm (0.9 lb). Shipping 1.5 Kg (3.3 lb).
Operating/ Storage:	-15 to 55 °C / -25 to 70 °C.
Power:	2 alkaline or lithium AA cells /2x NiMh AA cells External input via micro USB Selectable auto-off, low battery indicator and back lit display.
Battery life:	1000 hrs Power Meter / 80 hrs laser in modulation mode.
Case:	Rubber/Polycarbonate, 1 metre drop tested.
Display:	High contrast custom LCD, 74 x 55 mm / 2.9 x 2.2”
Tone detection:	150 ~ 9999 Hz ±1%.

SPECIFICATIONS

Power Meter: - KI2600 Series

Detector Type	Response λ nm	Damage Level dBm	Calibration λ nm	Power Range dBm	Autotest Sensitivity dBm	Mid range Linearity[1] dB	Calibration Accuracy[2] %	Polarisation Sensitivity dB	Total Uncertainty[3,5] dB
InGaAs	600 ~ 1700	+15	780, 820, 850, 980 **1270, 1290, 1300, 1310, 1330,** **1350, 1370, 1390, 1410, 1430,** **1450, 1470, 1490, 1510, 1530,** **1550, 1570, 1590, 1610, 1625,** 1650	+10 ~ -60 +10 ~ -70	-45 -50	0.02	1% (0.06 dB)	<0.005	0.3
H5 (InGaAs)	800 ~ 1650	+27[4]	820, 850, 980 **1270, 1290, 1300, 1310, 1330,** **1350, 1370, 1390, 1410, 1430,** **1450, 1470, 1490, 1510, 1530,** **1550, 1570, 1590, 1610, 1625**, 1650	+24 ~ -50 +24 ~ -60	-35 -40	0.02	1% (0.06 dB)	<0.005	0.35
Ge	600 ~ 1650	+25	635, 650, 660, 780, 820, 1590, 1610, 1625, 1650 **850, 980, 1270, 1290, 1300,** **1310, 1330, 1350, 1370, 1390,** **1410, 1430, 1450, 1470, 1490,** 1510, 1530, 1550, 1570	+15 ~ -50 +15 ~ -60	-40 -50	0.04	1 % (0.06 dB)	<0.005	0.5
					typical	typical		typical	max

Note 1: Mid range linearity excludes top 5 dB and bottom 10 dB of range.
Note 2: Calibration condition: non coherent light, -35±5 dBm, 23±1ºC, ±1 nm, 10±3 nm FWHM, PC ceramic connector, 100 µm fiber.
Note 3: Includes contributions of: varying optical connector types, calibration uncertainty, full temperature, dynamic range and fiber core diameter up to 200 µm.
Note 4: H5 can sustain the damage level for 2 minutes.
Note 5: At calibration wavelengths in bold type

SPECIFICATIONS

Power Meter: - KI2600XL Series

Detector Type	Response λ nm	Damage Level dBm	Calibration λ nm	Power Range dBm	Autotest Sensitivity dBm	Mid range Linearity[1] dB	Calibration Accuracy[2] %	λ Sensitivity ±30nm [5]	Polarisation Sensitivity dB	Response uniformity across detector	Total Uncertainty[3] dB
KI2600H3BXL-InGaAs2											
Filtered 2 mm InGaAs	800 ~ 1700	+35[4]	850 **980,1270,1300,1310,1330,1350, 1370,1390,1410,1430,1450,1470, 1490,1510,1530,1550,1570,1590, 1610,1625**,1650	+33 ~ -30 +33 ~ -40	*-30* -40	0.02	1% (0.06 dB)	0.03	<0.005	1% (0.06dB)	0.35
KI2600H3BXL-Ge2											
Filtered 2 mm Ge	600 ~ 1650	+35[4]	780,820,850, 1590,1610,1625,1650 **980,1270,1300,1310,1330,1350, 1370,1390,1410,1430,1450,1470, 1490**,1510,1530,1550,1570	+33 ~ -30 +33 ~ -40	*-10* -20	0.04	1% (0.06 dB)	0.04	<0.005	2% (0.09dB)	0.5
KI2600XL-InGaAs5											
5 mm InGaAs	800 ~ 1700	+15	780, 820, 850, **980,1270,1300,1310,1330,1350, 13701390,1410,1430,1450,1470, 1490,1510,1530,1550,1570,1590, 1610,1625**,1650	+10 ~ -50 +10 ~ -60	-50 -60	0.02	1% (0.06 dB)	0.03	<0.005	1% (0.06dB)	0.35
KI2600XL-Ge5											
5 mm Ge	600 ~ 1650	+20	635,650,660,780,820, 1590,1610,1625,1650 **850,980,1270,1290,1300,1310, 1330,1350,1370,1390,1410,1430, 1450,1470,1490**,1510,1530,1550, 1570	+15 ~-30 +15 ~ -40	-40 -50	0.04	1% (0.06 dB)	0.03	<0.005	2% (0.09dB)	0.5
KI2600XL-Si5											
5 mm Si	350 ~ 1100	+15	470, 520, **635,650,660,780,820,850**,980	+10 ~ -50 +10 ~ -60	-40 -50	0.02	1 % (0.06 dB)	0.03	<0.005	1% (0.06dB)	0.3
					typical	typical			typical		max

SPECIFICATIONS

Power Meter: - KI2300/KI2700 Series

Detector Type	Response λ nm	Damage Level dBm	Calibration λ nm	Power Range dBm	Autotest Sensitivity dBm	Mid range Linearity[1] dB	Calibration Accuracy[2] %	Polarisation Sensitivity dB	λ Sensitivity ±30 nm dB	Total Uncertainty[3] dB
InGaAs	600 ~ 1700	+15	*780, 820, 850, 980,* **1270, 1290, 1300, 1310, 1330, 1350, 1370, 1390, 1410, 1430, 1450, 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610, 1625**, 1650	*+10 ~ -60* +10 ~ -70	*-40* -50	0.02	1% (0.06 dB)	<0.005	0.03	0.3
Ge	600 ~ 1650	+25	635, 650, 660, 780, 820, 1590, 1610, 1625, 1650 **850, 980, 1270, 1290, 1300,** **1310, 1330, 1350, 1370, 1390,** **1410, 1430, 1450, 1470, 1490,** 1510, 1530, 1550, 1570	*+15 ~ -50* +15 ~ -60	*-40* -50	0.04	1% (0.06 dB)	<0.005	0.03	0.5
					typical	typical		typical		max

Note 1: Mid range linearity excludes top 5 dB and bottom 10 dB of range.
Note 2: Calibration condition: non coherent light, -35±5 dBm, 23±1°C, ±1 nm, 10±3 nm FWHM, PC ceramic connector, 100 µm fiber.
Note 3: Includes contributions of: varying optical connector types, calibration uncertainty, full temperature, dynamic range and fiber core diameter up to 200 µm.
Note 5: At calibration wavelengths in bold type

SPECIFICATIONS

Optical Light Source: KI 2800 Series

	1310/1550 nm Laser	Other Laser	650 nm VisiTest	850 / 1300 nm LED	1310 /1550 nm LED	Comments
Output Power, dBm/ Fiber Type, μm	0 @ 9/125	1 ~ 2 λ: -4 @ 9/125 3 ~ 4 λ: -7 @ 9/125	0	-20 @ 62.5/125 -22 @ 50/125 -32 @ 9/125	NA	± 1 dB
Power (dBm) @ Fiber type(μm)+ VisiTest	-3 @ 9/125	1 ~ 2 λ: -7 @ 9/125 3 ~ 4 λ: -10 @ 9/125	+2 @ 9/125	-23 @ 62.5/125 -25 @ 50/125 -35 @ 9/125	NA	± 1 dB
Short term stability, dB	0.04[1]	0.06[1]	N/A	0.01	NA	For 15 min, typ ± Δ 2°C, after warm up,ORL<-25
Stability over temp, dB	0.6	0.6	N/A	0.35	NA	Typical
λ initial tolerance, nm	20	20	5	N/A	20	At 25 °C
λ width, nm	3	3	3	NA	35/48	FWHM, typical
λ nm/°C	0.4	0.4	0.1	0.4	0.4	Typical
Mode Controlled Source	NA	NA	NA	Mode controlled	NA	50/125 compliant: IEC 61280-4-1 {Ed.1.0}, TIA/EIA 526-14A & TIA TSB-178.
Reconnection repeatability (dB)	0.1	0.1	0.1	0.05	0.1	95% confidence
Modulation	270 Hz, 1 kHz, 2 kHz±2 %, 12 Multi-Fiber ID tones, 2 Hz blink for Visitest					
Laser output power	Adjustable over 7 dB in 0.01 dB steps			NA	NA	

1) ORL < -25 dB.

SPECIFICATIONS

Optical Light Source: KI 2400 Series

	1310/1550 nm Laser	Other Laser	850 / 1300 nm LED	1310 /1550 nm LED	Comments
Output Power, dBm/ Fiber Type, μm	-4 @ 9/125	1 ~ 2 λ: -4 @ 9/125 3 ~ 4 λ: -7 @ 9/125	-20 @ 62.5/125 -22 @ 50/125 -32 @ 9/125	-20 @ 9/125	± 1 dB
Short term stability, dB	0.03[1]	0.05[1]	0.01	0.03	For 15 min, typ ± Δ 2°C, after warm up,ORL<-25
Stability over temp, dB	0.2	0.2	0.35	0.02	Typical
λ initial tolerance, nm	20	20	NA	20	At 25 °C
λ width, nm	3	3	NA	35/48	FWHM, typical
λ nm/°C	0.4	0.4	0.4	0.4	Typical
Mode Controlled Source	NA	NA	Mode controlled	NA	50/125 compliant: IEC 61280-4-1 {Ed.1.0}, TIA/EIA 526-14A & TIA TSB-178.
Reconnection repeatability (dB)	0.1	0.1	0.05	0.1	95% confidence
Modulation	270 Hz, 1 kHz, 2 kHz ± 2 %, 12 Multi-Fiber ID tones, 2 Hz blink for Visitest				
Laser output power	Adjustable over 7 dB in 0.01 dB steps		NA		

1) ORL < -25 dB.

SPECIFICATIONS

Optical Light Source: KI2700 Series

	1310/1550 nm Laser	Other Laser	650 nm VisiTest	850 / 1300 nm LED	Comments
Output Power, dBm/ Fiber Type, μm	0 @ 9/125	1 ~ 2 λ: -3 @ 9/125 3 ~ 4 λ: -7 @ 9/125	N/A	-20 @ 62.5/125 -22 @ 50/125 -32 @ 9/125	± 1 dB
Power (dBm) @ Fiber type(μm)+ VisiTest	-10 @ 9/125	1 ~ 2 λ: -7 @ 9/125 3 ~ 4 λ: -10 @ 9/125	-10 @ 9/125	N/A	± 1 dB
Short term stability, dB	0.04[1]	0.06[1]	N/A	0.01	For 15 min, typ ± Δ 2°C, after warm up,ORL<-25
Stability over temp, dB	0.6	0.6	N/A	0.35	Typical
λ initial tolerance, nm	20	20	5	N/A	At 25 °C
λ width, nm	3	3	3	NA	FWHM, typical
λ nm/°C	0.4	0.4	0.1	0.4	Typical
Mode Controlled Source	NA	NA	NA	Mode controlled	50/125 compliant: IEC 61280-4-1 {Ed.1.0}, TIA/EIA 526-14A & TIA TSB-178.
Reconnection repeatability (dB)	0.1	0.1	0.1	0.05	95% confidence
Modulation	270 Hz, 1 kHz, 2 kHz ± 2 %, 12 Multi-Fiber ID tones, 2 Hz blink for Visitest				
Laser output power	Adjustable over 7 dB in 0.01 dB steps			NA	

1) ORL < -25 dB.

SPECIFICATIONS

Optical Light Source: KI 2300 Series

	1310/1550 nm Laser	Other Laser	850 / 1300 nm LED	Comments
Output Power, dBm/ Fiber Type, μm	-4 @ 9/125	1 ~ 2 λ: -4 @ 9/125 3 ~ 4 λ: -7 @ 9/125	-20 @ 62.5/125 -22 @ 50/125 -32 @ 9/125	± 1 dB
Short term stability, dB	0.03[1]	0.05[1]	0.01	For 15 min, typ ± Δ 2°C, after warm up,ORL<-25
Stability over temp, dB	0.2	0.2	0.35	Typical
λ initial tolerance, nm	20	20	NA	At 25 °C
λ width, nm	3	3	NA	FWHM, typical
λ nm/°C	0.4	0.4	0.4	Typical
Mode Controlled Source	NA	NA	Mode controlled	50/125 compliant: IEC 61280-4-1 {Ed.1.0}, TIA/EIA 526-14A & TIA TSB-178.
Reconnection repeatability (dB)	0.1	0.1	0.05	95% confidence
Modulation	270 Hz, 1 kHz, 2 kHz ±2 %, 12 Multi-Fiber ID tones, 2 Hz blink for Visitest			
Laser output power	Adjustable over 7 dB in 0.01 dB steps		N/A	

1) ORL < -25 dB.

ORDERING INFORMATION

Power Meter: KI2600 Series

Instrument, Power Meter InGaAs	**KI2600 - InGaAs**
Instrument, Power Meter InGaAs, VFL	**KI2601 - InGaAs**
Instrument, Power Meter Ge	**KI2600-Ge**
Instrument, Power Meter Ge, VFL	**KI2601-Ge**
Instrument, Power Meter H5	**KI2600 - H5**
Instrument, Power Meter H5, VFL	**KI2601 - H5**

Power Meter: KI2600XL Series

Instrument, Power Meter Ge 5mm	**KI2600XL-Ge5**
Instrument, Power Meter InGaAs 5mm	**KI2600XL-InGaAs5**
Instrument, Power Meter Si 5mm	**KI2600XL-Si5**
Instrument, Power Meter H3B InGaAs 2mm	**KI2600H3BXL-InGaAs2**
Instrument, Power Meter H3B Ge 2mm	**KI2600H3BXL-Ge2**

Light Source: KI2800 Series

Instrument, Source 1310-1550 nm Laser	**KI2822**
Instrument, Source 1310-1550 nm Laser VisiTester	**KI28622**
Instrument, Source 850-1300 nm LED	**KI2803**
Instrument, Source 850-1300 nm LED VisiTester	**KI28603**
Instrument, Source 850-1300 nm LED, 1310-1550 nm Laser	**KI2824**
Instrument, Source 850-1300 nm LED, 1310-1550 nm Laser APC	**KI2824-APC**
Instrument, Source 850-1300 nm LED, 1310-1550 nm VisiTester	**KI28624**
Instrument, Source 850-1300 LED, 1310-1550 Laser VisiTester APC	**KI 28624-APC**
Instrument, Source 850-1300 nm LED VisiTester, 1310-1550 nm Laser VisitTester	**KI28634**
Instrument, Source 850-1300 nm LED, 1310-1550 nm VisiTester APC	**KI28624-APC**
Instrument, Source 1310-1550-1625 nm Laser APC	**KI28010-APC**
Instrument, Source 1310-1550-1625 nm Laser VisiTester APC	**KI28610-APC**
Instrument, Source 1310-1490-1550-1625 nm Laser, APC	**KI28016-APC**

ORDERING INFORMATION

Light Source: KI2400 Series

Instrument, Source 1310-1550 nm ultra stable Laser	**KI2422**
Instrument, Source 1310-1550-1625 nm ultra stable Laser, APC	**KI24010-APC**
Instrument, Source 1310-1550 nm ultra stable eLED	**KI2419**

Loss Test Meter: KI2700 Series

Instrument, LTS 1310-1550 nm, InGaAs	**KI 2722-InGaAs**
Instrument, LTS 1310-1550 nm VisiTester, InGaAs	**KI 27622-InGaAs**
Instrument, LTS 850-1300 nm, Ge	**KI 2703-Ge**
Instrument, LTS 850-1300 nm VisiTester, Ge	**KI27603-Ge**
Instrument, LTS 850-1300 nm, 650 nm VFL, Ge	**KI27703-Ge**
Instrument, LTS 850-1300 nm, 1310-1550 nm, Ge	**KI2724-Ge**
Instrument, LTS 850-1300 nm, 1310-1550 nm APC, Ge	**KI2724-Ge-APC**
Instrument, LTS 850-1300 nm 1310-1550 nm VisiTester, Ge	**KI27624-Ge**
Instrument, LTS 850-1300nm 1310-1550nm VisiTester APC, Ge	**KI27624-Ge-APC**
Instrument, LTS 850-1300 VisiTester, 1310-1550 VisiTester, Ge	**KI 27634-Ge**
Instrument, LTS 1310-1490-1550 nm APC, InGaAs	**KI2727-InGaAs-APC**
Instrument, LTS 1310-1490-1550 nm VisiTester APC, InGaAs	**KI27627-InGaAs-APC**
Instrument, LTS 1310-1550-1625 nm APC, InGaAs	**KI27010-InGaAs-APC**
Instrument, LTS 1310-1550-1625 nm VisiTester APC, InGaAs	**KI27610-InGaAs-APC**
Instrument, LTS 1310-1490-1550-1625 nm APC, InGaAs	**KI27016-InGaAs-APC**

Loss Test Meter: KI2300 Series

Instrument, LTS 1310/1550 nm ultra stable, InGaAs	**KI2322-InGaAs**
Instrument, LTS 1310-1550-1625 nm ultra stable APC, InGaAs	**KI23010-InGaAs-APC**

ORDERING INFORMATION

Standard Accessories:
SC metal-free optical connector adaptors, KITS™ PC software and USB cable, user manual, calibration certificates, carry pouch, carry strap.

Optical Connectors:

These instruments have interchangeable optical connectors. The power meter works with both PC and APC connectors. The light source ferrule type is fixed and customer specified as either PC or APC. Green is associated with APC connectors.

Optional Interchangeable Connector Adaptors:

Description	P/N	Description	P/N
E2000/LSH, blue	**OPT060**	D4	**OPT055**
E2000/LSH, green	**OPT060G**	Universal 2.5mm	**OPT081**
LSA/DIN 47256	**OPT071**	SMA 905/906	**OPT082**
LC / SC, metal body	**OPT076**	FC	**OPT051**
MU	**OPT080**	ST	**OPT040**

Optional Accessories:

Description	P/N
Option, Carry Case for 2 Instruments	**OPT153**
Option, Carry Case includes Cletop-style cleaner & Cleaning Sticks	**OPT154B**

ORDERING INFORMATION

Standard Accessories (for KI2600XL series):

Description	Quantity
Operating manual	1
Calibration certificate	1
KITS™ Recording/Reporting software	1
Soft carry pouch	1
Wrist strap	1
USB cable	1

Optical Connectors:

The power meter works with both PC and APC connectors.

To order KI2600XL Series Optical Power Meter, please specify instrument and at least one optional interchangeable connector adaptor.

Optional Interchangeable Connector Adaptors (for KI2600XL series):

Description	P/N	Description	P/N
ST	OPT202	Universal 1.25mm	OPT224
SC	OPT201	Universal 2.5mm	OPT225
E2000/LSH	OPT220	LSA/DIN EC	OPT207 OPT221
D4	OPT206	MTRJ	OPT223
MU	OPT222	Diamond 3.5mm Threaded	OPT208
Biconic	OPT205	MPO	OPT227
LC	OPT226	SMA 905/906[5]	OPT203
Toslink5	OPT230	SMI[5]	OPT231
FC	OPT204	POF cable, mini Toslink, HFBR series, 2.5, 1.25 mm[5]	OPT229

Optional Accessories (for KI2600XL series):

Description	P/N
Option, Carry Case for 2 Instruments	OPT153
Option, Carry Case includes Cletop-style cleaner & Cleaning Sticks	OPT154B

There are no internal user adjustments. Calibration is performed without opening the instrument.

Before commencing calibration:

- Clean all optical connectors very carefully.
- Ensure that all devices have been at a stable room temperature for over an hour, and that the light source is fully warmed up at the wavelength to be calibrated.

Note: instrument has to be powered externally while doing manual calibration.

Perform calibration as per instructions below. When calibration is completed, place an anti-tamper label over the hole. Do not forget to update your calibration records and to schedule the next calibration service.

Power Meter Calibration

Calibration is a transfer process. It is performed by setting up a light source at a stable, but non-critical power level between 0 and -30 dBm, and adjusting the meter reading to the same value as that shown by a reference meter.

Required are laser and LED light sources with accurate, calibrated wavelengths and good power stability, a power meter with appropriate calibrated wavelengths, single mode and multimode test leads. Check the calibration certificates on your reference equipment to ensure current validity.

Known calibration constants can be re-entered directly without using other equipment. This is useful in case old calibration constants are to be put back.

Record the existing calibration offsets, re-enter or adjust known offsets at this point or calibrate the meter at the selected wavelength as follows:

- Remove batteries.
- Using tweezers, place a link across gold plated calibration contacts inside battery compartment, Figure 2. Turn on external power via micro USB.

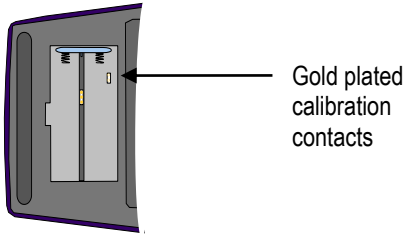


Figure 2. Link has to be placed across gold plated calibration contacts

- Press [-] or [+] to set the wavelength to be calibrated.
- Record the light source power measured by reference power meter.
- Transfer this power level to the meter to be calibrated.
- To modify calibration, press [F3] or [F4].

- To save new calibration setting, press [Set Ref].
- To cancel unsaved changes, press [Home].

Light Source Calibration

The emitter power level can be re-calibrated, and the current checked.

Required are reference power meter with appropriate calibrated wavelengths, single mode and multimode test leads. Check the calibration certificates on your reference equipment to ensure current validity.

CAUTION! Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Calibrate the source at the selected wavelengths as follows:

- Remove batteries.
- Using tweezers, place a link across gold plated calibration contacts inside battery compartment, Figure 2.Turn on external power via micro USB.
- Press [F1] to select source calibration.

  Press [+] or [-] to set the wavelength to be calibrated. Measure light source power using the reference meter.
- Set the emitter power to the required level by pressing [F3] or [F4].
- Press [F2] to save new value.
- To return to main calibration menu, press [Home]
- To cancel unsaved changes, press [Toggle centre] or [Home].
- Repeat the above process for any additional wavelengths if required.

CAUTION!

- Do not open instrument unless warranty has expired and you are authorised to do so. Opening the unit will invalidate any warranty claim.
- This unit contains static sensitive devices. Anti-static handling procedures should be observed at all times when handling internal circuits.
- There are no internal user adjustments. All calibration is performed without opening the instrument. The optical sensor / connector assembly is not user serviceable.

PERFORMANCE VERIFICATION TESTS

All tests can be performed without access to the interior of the instrument.

The test procedures described in this section are for performance verification of a KI2600 InGaAs Power Meter and KI2822 Light Source.

Due to the large number of possible instrument configurations, it is not possible to give detailed test procedures for all options in this manual, so some parameters may need adjusting to the appropriate specifications.

Required Equipment This is the required equipment for the performance test listed. Any equipment that satisfies the critical specifications of the equipment given in the table may be substituted for the recommended models.

Test Record Results of the performance test may be tabulated on a photocopy of the Test Record provided at the end of this test procedure. It is recommended that you fill out the Test Record and refer to it while doing the test. Alternatively, a soft copy of this manual may be obtained from our web site.

Test Failure If the equipment under test fails any performance test, return the instrument to the nearest Sales/Service Office for repair.

Instrument Specification Specifications are the performance characteristics of the instrument that are certified, and are the limits against which the equipment under test can be tested.

Any changes in the specifications due to manufacturing changes, design will be covered in a manual change supplement or revised manual. Such specifications supersede any that were previously published.

General Instructions

Perform each step in the order given, using the corresponding test equipment. Use Tables 1 ~ 3 to record general test details.

The SMF / MMF test lead fiber type and PC / APC connector polish must be matched to the instrument type.

Make sure that all optical connections are dry and clean. **DO NOT USE INDEX MATCHING OIL**. For cleaning, use the cleaning instructions given in the section ‘Optical Connector’.

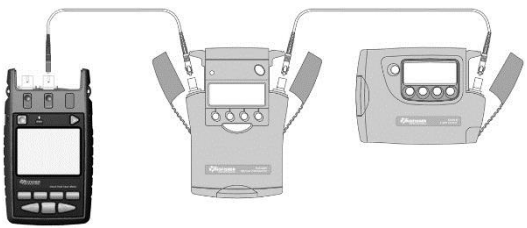
Make sure that all patch cords are fixed to the table so that they won't move during measurements.

Ensure that the ambient conditions are in the following ranges:
Temperature: 21 ± 3 ºC
Relative humidity: 45 to 75 %

Power Meter:

Accuracy Test

1. Connect the Power Meter to Attenuator to Light Source:



Power Meter **Attenuator** **Light Source**

2. Switch on all instruments.
3. Set all instruments to 1310 nm.
4. Change the attenuation of the attenuator until the reference power meter displays -10.00 dBm. Note the attenuator setting in setting 1 of Table 4.

   If the light source is powerful enough to give -4.00 dBm, set the attenuator to 2.5 dB and correct the appropriate values in the test report.

   Repeat the above for reference power meter readings of

   -20dBm, -30 dBm, -40 dBm and -50 dBm (last reading not relevant to H series power meters).
5. Measure the DUT:

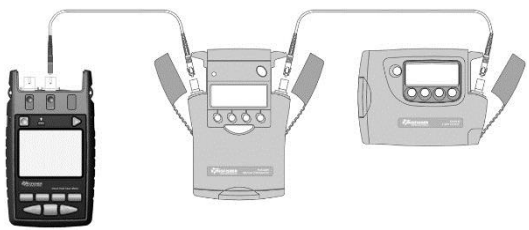
   Re-connect the attenuator output cable to the DUT power meter port, and select the 1310nm on DUT.

   Set the attenuator to its value for setting 1. Note the displayed power level of the DUT in the test record.

   Repeat the above for attenuator settings 2~5.
6. Repeat the Power Meter Accuracy Test at 1550 nm.

Verification of Autotest range, tone detector and linearity test

Test below is to verify Autotest range, tone detector operation and linearity for Power Meter. Connect the Power Meter to Attenuator to Light Source



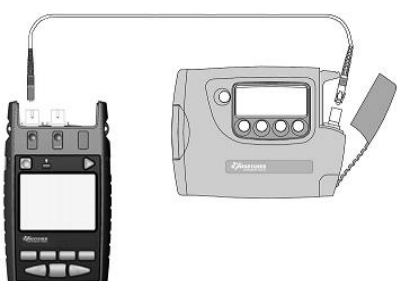
Power Meter **Attenuator** **Light Source**

2. Switch on all instruments.
3. Set the Light Source to 1310nm and allow to warm up. Press [Autotest].
4. On the attenuator, set the wavelength to 1310nm and attenuation to 5 dB.
5. Make sure that Autotest is updating. Note the measured optical power at 1310 nm.
6. For single mode instruments, repeat the power readings for attenuator settings of 15 dB, 25 dB and 35 dB. For instruments with H series meter, repeat the readings for an attenuator setting of 15 dB only.
7. For multimode instruments, repeat the power readings for attenuator settings of 15 dB, 20 dB.
8. Repeat the above for 1550nm as required, however, this test typically only needs performing at one wavelength.

Optical Light Source

Output Power (CW) Test

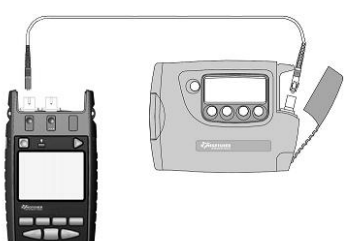
1. Connect the Light Source to the Power Meter as shown.
2. Switch on the instruments.
3. Set the Optical Power Meter to 1310 nm
4. On Light Source, enable the source and set the wavelength to 1310 nm.
5. Note the measured power level value in the test report in Table 5.
6. Repeat the above on 1550 nm.



Light source **Power Meter**

Short Term Stability Test (optional)

1. Connect the Light Source to the Power Meter as shown. For better stability, ensure that connector plugged into power meter has APC termination.
2. Set the optical power meter to 1310 nm. 3. On Light Source, enable the source and set the wavelength to 1310 nm.
4. Let the unit warm-up for 15 minutes then note the power.
5. Record the power every 30 seconds for 3 minutes.
6. Calculate max-min values for stability (< 0.1dB).
7. Record test results in Table 5.



Light Source **Power Meter**

Time	Measured power, dBm	Drift, dB	Tick max/min values
00 sec		0.00	
30 sec			
60 sec			
90 sec			
120 sec			
150 sec			
180 sec			

Note: The same instructions apply to Short Term Stability Test on 850/1300 nm Light Sources. For improved stability, mandrel wraps should be used in the case of 850/1300nm.

Optical Light Source

Centre wavelength and Spectral Bandwidth (FWHM) Test (optional)

1. Connect the Light Source to OSA as shown.
2. Switch on the instruments and allow to fully warm up.
3. On Light Source, enable the source and set the wavelength to 1310 nm.
4. On the OSA, press the [Instr Preset] key
5. Press [Auto/Meas] and wait until 'End of Automeasure' is displayed
6. Choose [User] and select the type of source to be measured (FP for Fabry Perot laser).
7. To show the display in linear mode:
   - Press [Menu].
   - Press [Amptd] on the left side of the display.
   - Press [Linear] on the right side of the display.
8. To ensure interference - free reading of the display it is advisable to stop the repeating calculations.
   - Press [User].
   - Press [Single Sweep].

   If the trace on the display is not clear, you can change resolution by using the span key.
9. From the displayed measurements check and note the values for "mean wavelength" (Centre wavelength) and "FWHM" (Spectral Bandwidth) in the test report, Table 6.
10. Repeat the test with the source wavelength set to 1550 nm.

Test set-up for the Centre wavelength and Spectral Bandwidth test

PERFORMANCE VERIFICATION TESTS

Instrument / Accessories	Recommended Model	Required Characteristics	Alternative Model
Optical Light Source	KI2400		KI7400C, KI7800C
Optical Power Meter	KI2600		KI7700C
Optical Attenuator	KI7013B		KI7013B
Connector adaptors			
SMF patch leads			
For optional test only			
Optical Spectrum Analyser	71450B		71452B, (8164xA,B)
Connector Adaptors			
SMF patchleads			

Table 1: Required Equipment for KI2000 Series Performance Verification Tests

PERFORMANCE VERIFICATION TESTS

Model:		Date:
Serial No.:		Ambient Temperature: °C
Options:		Relative Humidity: %
Firmware Revision:		Line Frequency: Hz
Test Facility:		Customer:
Performed by:		Report No.:
Special Notes:		

Table 2: General Test Record

PERFORMANCE VERIFICATION TESTS

	Description		Model No.		Trace No.		Calibration due date
1.	Optical Light Source						
2.	Optical Power Meter						
3.	Optical Attenuator						
4.							
5.							
6.							
7.							
8.							
9.							
10.							

Accessories:
SMF patchleads
Connector adaptors

Table 3: Equipment Record for Performance Verification Tests

Model: Report No.: Date:

Total Uncertainty / Accuracy Test							
	Test Wavelength = nm						
Setting Number	Power Meter reference value	Attenuator Setting		Minimum specification (-0.3 dB of Ref.)	DUT measurement results		Maximum specification (+0.3 dB of Ref.)
1.	(~-10.00 dBm)		dB	(~-10.30 dBm)		dBm	(~-9.70 dBm)
2.	(~-20.00 dBm)		dB	(~-20.30 dBm)		dBm	(~-19.70 dBm)
3.	(~-30.00 dBm)		dB	(~-30.30 dBm)		dBm	(~-29.70 dBm)
4.	(~-40.00 dBm)		dB	(~-40.30 dBm)		dBm	(~-39.70 dBm)
5.	(~-50.00 dBm)		dB	(~-50.30 dBm)		dBm	(~-49.70 dBm)
				Measurement Uncertainty		dB	

Table 4: Accuracy Test Record for KI2600 Series Power Meter

Note 1: This is for the KI2600-InGaAs. For the H series instruments, increase by ±0.2 dB.

PERFORMANCE VERIFICATION TESTS

Model:	Report No.		Date:	

Output Power (CW) Test

Wavelength	Minimum Specification	DUT Measurement Results		Maximum Specification
1310 nm	-1.00 dBm	_____	dBm	
1550 nm	-1.00 dBm	_____	dBm	
Measurement Uncertainty		_____	dB	

Short-Term Stability Test (optional)

1310 nm		_____	dBpp	(0.10 dBpp) 0.04 dBpp typical
1550 nm		_____	dBpp	(0.10 dBpp) 0.04 dBpp typical
Measurement Uncertainty		_____	dB	

Table 5. Output Power Test and Short Term Stability Test Record for KI 2000 Series Optical Light Source

Model:	Report No:		Date:	

Central Wavelength & Spectral Bandwidth (FWHM) Test (optional)

Wavelength	Minimum Spec.	DUT Measurement Results		Maximum Spec.
Centre wavelength				
1310 nm	1290 nm	_____	nm	1330 nm
1550 nm	1530 nm	_____	nm	1570 nm
Spectral Bandwidth (FWHM)				
1310 nm		_____	nm	(6nm) 3 nm typical
1550 nm		_____	nm	(6nm) 3 nm typical
Measurement Uncertainty		_____	dB	

Table 6. Central wavelength Test Record for KI 2800 Series Optical Light Source

Model:	Instrument Connector: APC [ ] PC [ ]	Report No.:		Date:	
Fiber Type: Single mode [ ] Multimode [ ]					
Range and Linearity Test					
No	Attenuator setting	Power Meter Reading	Linearity Calculation	Acceptable Linearity Range[1]	
1	5.00 dB		-		
2	15.00 dB		No 2 – No 1 =	9.50 ~ 10.50	
3	20.00 / 25.00 dB		No 3 – No 2 =	4.50 ~ 5.50 / 9.50 ~ 10.50	
4	35.00 dB		No 4 – No 3 =	9.50 ~ 10.50	

Table 7: Test Record for Autotest Performance Verification Tests, KI2600 Series Power Meter

Note1: The linearity range here is typically limited by attenuator linearity, rather than instrument performance.

QUICK REFERENCE GUIDE: POWER METER

KI2600 POWER METER, KI2300/KI2700 LOSS TEST METER

Manual operation

- To remove interchangeable connector adaptor, press button on front of case and pull off adaptor. This may be easier with a test lead attached.
- To turn on press [On/Off]
- To defeat auto power-off**,** hold [On/Off] for 3 seconds at turn on until 'Perm' is displayed.
- Low battery is indicated with a battery symbol.
- To enter Meter menu, press [Meter]
- To enter Memory menu, press [Memory]
- To return to Home menu, press [Home]
- To save memory to USB stick, in Memory menu, insert stick and press [►].
- To turn on back light press [Backlight]

Meter Menu:

- To select operational wavelength, press [-] or [+].
- To set reference, press [Meter Mode] to enter 'dB R', then press and hold [SET REF] for 3 seconds. Meter displays about 0.00 dB R.
- To stop / start display update, press [HOLD].
- If a test tone is detected, meter will display 'Hz.'
- To toggle log / linear/relative display mode, press [Meter Mode].
- To store to memory press [Store]

Autotest Operation

- To start Autotest, press [AUTOTEST] on Light source.
- To stop / start display update, press [HOLD].
- To toggle logarithmic / linear / relative display mode, press [Meter Mode]. Measured optical power will be displayed in 'dBm', 'µW' or 'dB R'.
- To view the nominal source power, press [Meter Mode] to enter 'dBm' or 'µW', then press [+].
- To set reference, press [Meter Mode] to enter 'dB R' then press and hold [Set Ref] for 3 seconds.
- To view reference value, press [Meter Mode] to enter 'dB R', then press [+].

Memory Operation

- To record data to internal memory in Meter or Autotest modes, press [►]. Data will be stored in the next location.

Memory menu:

- To select stored reading press [-] or [+]
- To clear memory press and hold [Toggle centre] then press [On/Off]

Visible laser option

- Select [On/Off], [SOURCE]

QUICK REFERENCE GUIDE: LIGHT SOURCE

KI2400/KI2800 HAND HELD FIBER SOURCE,
KI2300/KI2700 LOSS TEST METER

Manual operation

- To remove interchangeable connector adaptor, press button on front of case and pull off adaptor. This may be easier with a test lead attached.
- To turn on press [On/Off]
- To defeat auto power-off**,** hold [On/Off] for 3 seconds at turn on until 'Perm' is displayed.
- Low battery is indicated with a battery symbol.
- To enter Source menu, press [Source]
- To return to Home menu, press [Home]
- To turn on back light press [Backlight]

Source Menu:

- Press [-] or [+] to select operating wavelength.
- To change power level, press [F2] then use [-] or [+] (laser light source only, not available for LED sources)
- To restore default power level, press [F2] then press [Toggle centre] (laser light source only, not available for LED sources)
- To select modulation while source is on, press and release [Mode]. Press [Mode] again to select next available frequency or ID-tone. Alternatively, press and hold [Mode] then use [-] or [+] to cycle through all options.
- To end modulation, press and hold [Mode] then press [Toggle centre]. Alternatively, press and hold [Mode] for 3 sec.

Autotest Operation

- To start Autotest, press [AUTO].
- To check wavelength status, eg if it is selected for limited wavelength AutoTest, press [F4] while source is on.
- To toggle selection of wavelengths for limited wavelength AutoTest, press and hold [Toggle centre] then press [F4] while source is on.

  To start limited wavelength AutoTest, press and hold [Toggle centre], then press [Auto].

DISCLAIMER AND WARRANTY

Information in this manual is given in good faith for the benefit of the user. It cannot be used as the basis for claims against Kingfisher International or its representatives, if accidental damage or inconvenience results from use or attempted repair of the equipment.

Kingfisher International products are guaranteed against defective components and workmanship for a period of 3 years from the date of delivery, unless specifically stated in the original purchase contract or agreement. This warranty excludes optical connectors or incorrect use. Opening the instrument will invalidate the warranty. Liability is limited solely to repair of the equipment.

KINGFISHER INTERNATIONAL PTY. LTD.

30 Rocco Drive, Scoresby, VIC 3179 Australia

Phone: (61) 3-9757-4100

Fax: (61) 3-9757-4193

E-mail: sales@kingfisher.com.au

Website: www.kingfisherfiber.com

Technical data is subject to change without notice as part of our program of continuous improvements. Therefore please verify critical parameters before ordering. Australian and international patents granted.

NOTES

Please use these pages to write notes

NOTES

NOTES